TG Steels

2510 PRIME

One of the most economical cold work tool steels, suitable for most of the cold work tools with high surface hardness after heat treatment

2510 PRIME;

- is a low medium alloyed steel produced by a process that ensures good level of cleanliness.
- has a high surface hardness after heat treatment leading to good wear resistance associated with good toughness.
- has good dimensional stability.
- has better wear resistance than the 2842 without any decrease on the toughness because of the alloying with 0.6% W.

Applications

2510 PRIME is used for the manufacture of cutting and punching tools up to 6 mm thick eventually up to 10 mm. It can also be used for the manufacture of taps, slides, gauges, guide columns, as well as for highly abrasive plastic mold cavities and gates for forming, blanking dies, deep drawing dies, shearing dies and tools and also in roll forming operations: rolls and tools.

2510 PRIME can also be used for the production of shear blades for paper and plastics.

Main properties

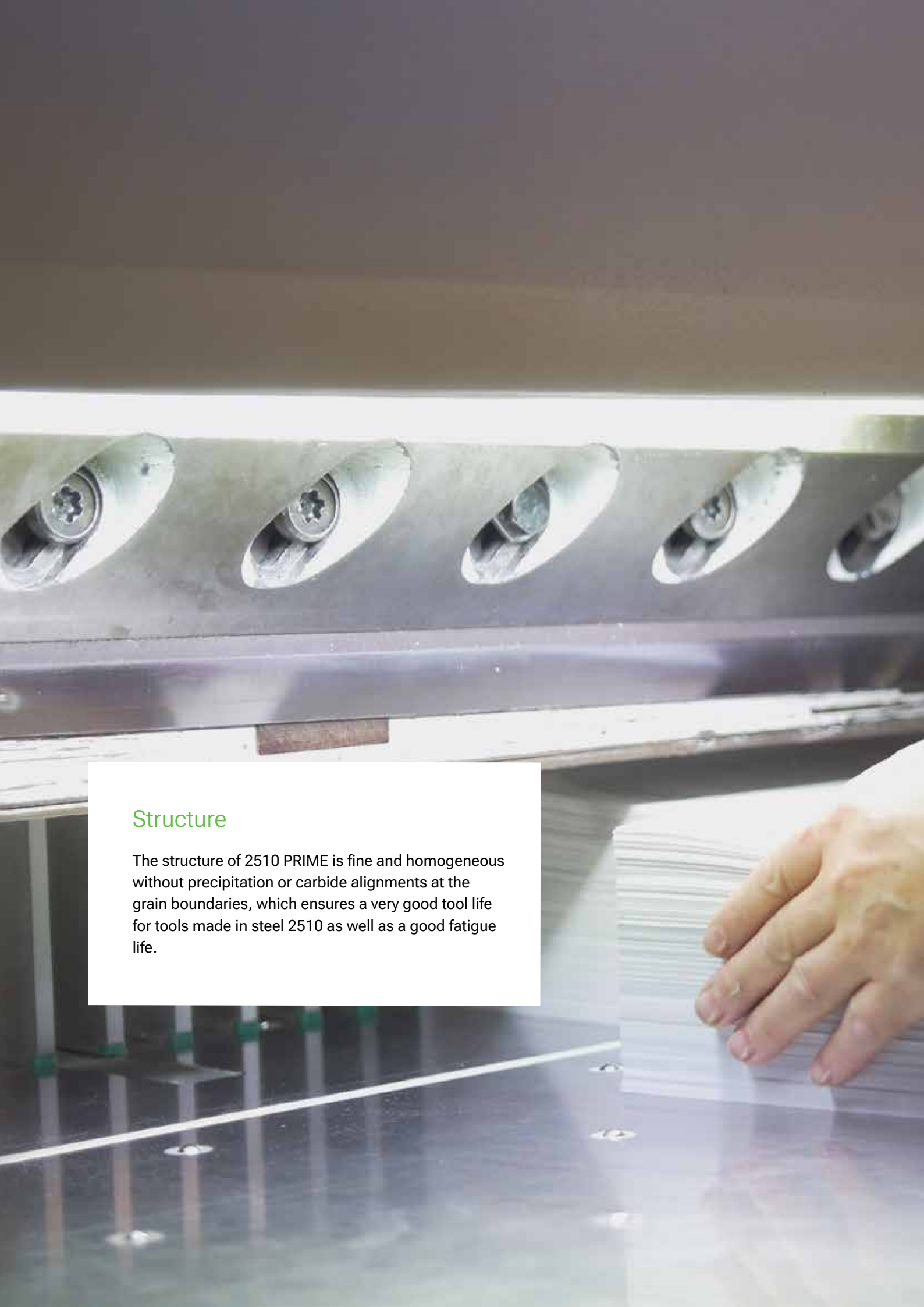
- Good combination of high surface hardness *(good wear resistance)* and good toughness
- Good machinability
- Good dimensional stability

Chemical composition *(typical)*

C	Si	Mn	Cr	W	V
1.00	0.25	1.10	0.60	0.60	0.10

Designation

Werkstoff Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1.2510	95MnWCr5	-	SKS3	-	O1	-	-	-



Structure

The structure of 2510 PRIME is fine and homogeneous without precipitation or carbide alignments at the grain boundaries, which ensures a very good tool life for tools made in steel 2510 as well as a good fatigue life.

Hardness at the time of delivery

Annealed for 230 HB max.

Physical properties

Temperature	20°C	200°C	400°C
Volumic mass kg/m³	7780	7730	7650
Young Modulus N/mm²	195000	180000	169000
Thermal conductivity W/m.K	33	34	35
Coefficient of linear expansion 10^{-6}/K	11.5	11.7	11.4

Heat treatment

SOFT ANNEALING

Temperature: 740 - 770°C, duration 1h + 1h for 25 mm thickness. slow cooling in the furnace *(10 to 20°C/h)*. The atmosphere in the furnace must be reducing to avoid decarburization of the steel.

STRESS RELIEVING

After machining, it is recommended to stress relieve at a minimum of 2 hours, followed by slow cooling in the furnace.

AUSTENITIZATION

In order to avoid any risk of cracking it is recommended to preheat in 1 step.

- 1st preheating step:
  temperature: 650°C time: 30 s/mm of thickness

Recommended austenitizing temperature: 790 - 820°C. The holding time should not be too long to avoid a risk of grain coarsening and a loss of toughness. It is recommended to keep the room for 30 minutes at the austenitizing temperature, as soon as the core of the room has reached the austenitizing temperature.

QUENCHING MEDIUM

Oil at 80°C, vacuum *(pressure > 6 bars)*, salt bath 500 - 550°C.
To ensure good toughness, treatment with oil or salt bath is preferable. The hardness after quenching is 64 HRC.

SUB ZERO TREATMENT

For parts that need to have high dimensional stability and to increase wear resistance without reducing toughness, it is recommended to cold run at a temperature between -110°C and -190°C for hour for 25 mm of thickness of the part. This treatment transforms the residual austenite *(unstable and not very hard phase)* into martensite *(stable and hard)*. This treatment is optional for common applications.

TEMPERING

To ensure a minimum residual austenite rate as well as greater tool stability, it is essential to perform a double *(triple is better)* tempering. Each tempering is followed by a cooling under 100°C.

Each tempering time must be at least equal to 1h + 1h for 25 mm of thickness of the treated part *(equivalent thermal thickness)*.

Note:

Hardness as a function of tempering temperature:
The usual hardness for cold working uses is in the range of 58 to 61 HRC and is obtained by tempering between 450 and 500°C. Higher tempering temperature can be performed for hot work applications. In order to avoid the formation of large carbides that are detrimental to toughness, it is preferable to carry out austenitization at the lowest possible temperature, i.e. 1000 or 1020°C.

The recommended hardness for cold work is:
1. Cold shears: 54 to 59 HRC
2. Forming tools:

- *Material up to 3 mm thick: 59 - 61 HRC*
- *Material thickness from 3 mm to 6 mm: 57 - 59 HRC*
- *Material thickness 6-10 mm: 53 - 56 HRC*

3. Wear pads for molds: 59 - 62 HRC

Surface treatment

Nitriding

2510 PRIME is usually not suitable for nitriding because of the low tempering temperature of it.

PVD, CVD

2510 PRIME is suitable for all kinds of PVD and CVD treatment as soon as the treatment temperature is 30°C lower than the last tempering temperature.

Polishing

2510 PRIME is perfectly suitable for polishing in the treated state and can be used for applications requiring a sufficiently high polish level for translucent - transparent parts *(Rt ≤ 20 µm, CNOMO level 2, Rugotest N7).* Optimal polishing is achieved by performing consecutive steps of fairly close roughness and stopping each step as soon as the last scratch of the previous step disappears

Machining

The machining parameters below are given for information only and must be adapted according to the equipment and usual machining conditions.

TURNING

	Carbide tool		HSS tool
	Rough machining	Finishing	Finishing
Cutting speed m/min	150 - 200	200 - 250	20 - 25
Feed mm/r	0.2 - 0.4	0.1 - 0.2	0.1 - 0.2
Depth of cut mm	2 - 4	0.5 - 2	0.5 - 2

MILLING: SURFACING

	Milling with carbide tools		Solid tool
	Rough machining	½ Finishing	Finishing
Cutting speed m/min	160 - 230	260 - 280	160 -180
Feed mm/r	0.2 - 0.4	0.1 - 0.2	0.02 - 0.2
Depth of cut mm	2 - 4	1 - 2	

HSS TWIST DRILL

Drill diameter mm	Cutting speed m/min	Feed mm/t
< 5	14 - 16	0.10 - 0.20
5 - 10	14 - 16	0.20 - 0.30
10 - 15	14 - 16	0.30 - 0.35
15 - 20	14 - 16	0.35 - 0.40

DRILLING: CARBIDE DRILL

	Carbide type		
	Indexable insert	Solid carbide	Carbide tip
Cutting speed m/min	200 - 230	105 - 135	65 - 85
Feed mm/t	0.05 - 0.15	0.10 - 0.25	0.15 - 0.25

FINE GRINDING

General indications for grinding wheels to be used on 2510 PRIME in the heat treated condition Usually, rather soft vitrified aluminum oxide grinding wheels *(grades G for plane grinding to K for cylindrical grinding)* are used.

Particular attention will be paid to effective cooling of the surface during grinding to prevent degradation of the material surface.

ELECTRO-DISCHARGE MACHINING

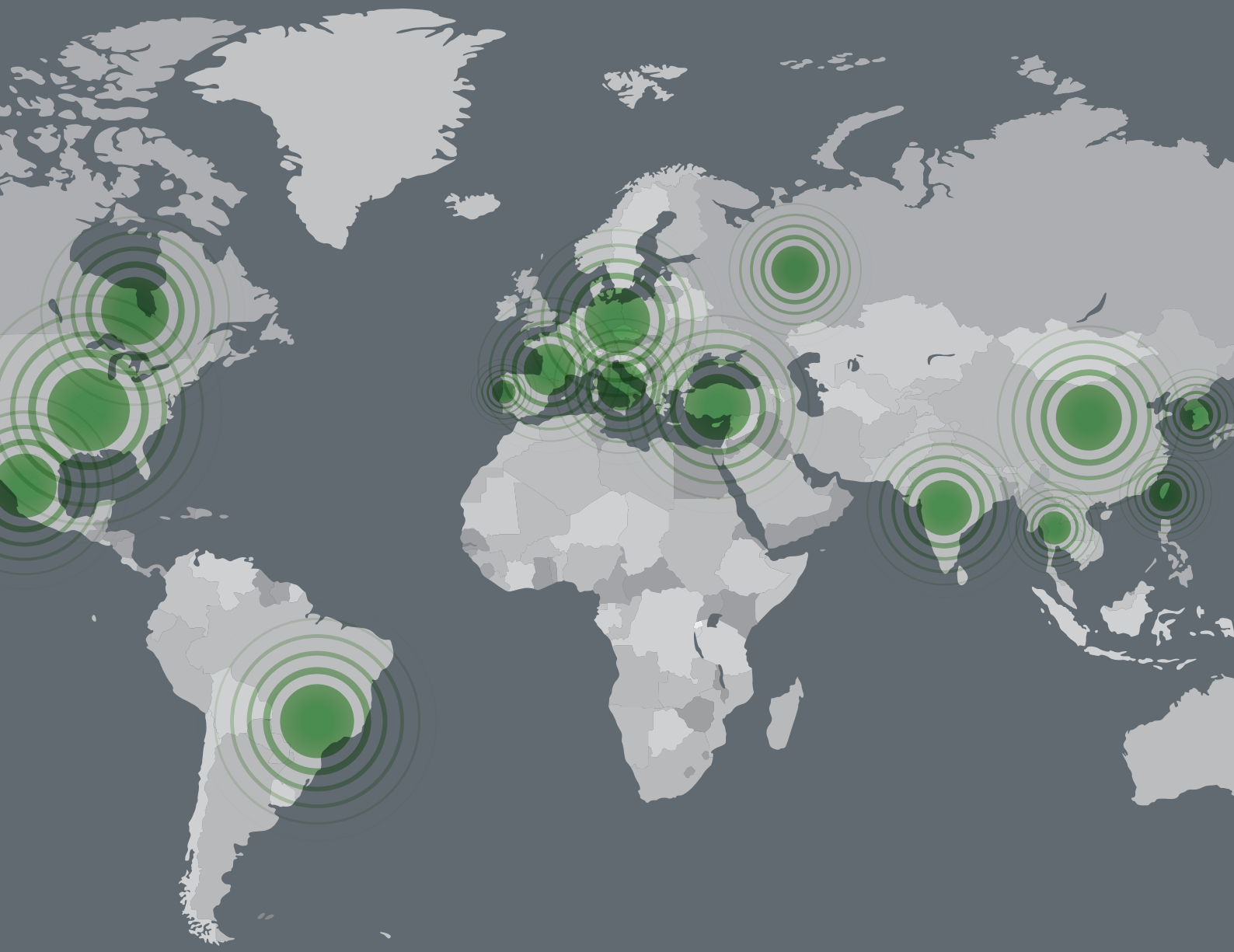
2510 PRIME is also suitable for EDM machining *(wire or electrode)*. Preferably, the machining will be carried out with a low current density and a high frequency in order to limit the thickness of the white layer as much as possible.

Then it is necessary to carry out a stress relieving at 25°C below the last tempering in order to reduce the level of residual stresses *(which could lead to a risk of cracking)* and to carry out a polishing to completely remove the white layer formed during the discharge machining process.

Welding

2510 PRIME could be welded either in the annealed condition *(better)* or in the heat treated condition.

- Method: TIG
- Feeder wire: AISI O1 or AWS312
- Preheating: 250°C. hold at 200°C during the welding operation
- Post treatment
  - » In the treated state: tempering for a minimum of 2 hours at 20°C below the initial tempering temperature.
  - » In the annealed state: carry out a soft annealing under the usual conditions: temperature: 740 - 770°C, duration 1h + 1h for 25mm of thickness. Slow cooling in the furnace *(10 to 20°C/h).*



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